DOCUMENT RESUME

ED 190 119 IR 008 604

AUTHOR Kurfiss, Joanne
TITLE Linking Psychological Theory and Instructional Technology.
NOTE 13p.; Paper presented at a conference at Eastern Montana College (Billings, MT, April 20, 1980).

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS College Students; Concept Formation; *Educational Technology; Higher Education; Learning Theories; *Memory; *Motivation; *Psychological Studies; *Relationship

ABSTRACT

Based on the assumption that the design of instruction and the selection of technological supports can be based upon psychological understandings of what makes for a meaningful learning experience, this paper examines meaning in the context of two propositions about the nature of motivation and memory, and explores ways in which instructional technology can be used as a tool in the process of creating meaningful learning experiences for college students. The two propositions considered are: (1) that external stimuli are effective motivators only when they are meaningful or form some relationship to internal states, and (2) that the more organizing and the higher the level of organizational activity done by the student, the greater the probability that he or she will be able to retain and use the information acquired. (FM)

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LINKING PSYCHOLOGICAL THEORY AND INSTRUCTIONAL TECHNOLOGY

by

Joanne Kurfiss

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LINKING PSYCHOLOGICAL THEORY AND INSTRUCTIONAL TECHNOLOGY

Joanne Kurfiss, Ph.D.
Instructional Development
Weber State College

Although some 60's activists may have thought they invented the notion of "relevance" as applied to education, in fact theorists in the field have long urged educators to make learning more meaningful. While theorizing and exhortations have abounded, however, practical suggestions have not been plentiful. Accounts of successful teaching/learning experiences (ranging from work such as Holt's and Kozols' to Ralph Nader's recent suggestions for college students; Change, December 1979) tend to be discounted by the academic world since they rarely present systematic documentation of results, or broad guidelines to help others replicate their successes. Psychological theory and research goes to the other extreme; it is often difficult for the average teacher to see the immediate or long-range implications of specific research results, even if that teacher should miraculously find the time to examine that august (and gargantuan) body of knowledge. Material summarizing known psychological concepts in a form useful to teachers, and then providing examples of the concepts in use, is rare, although this is beginning to change as educators and psychologists move toward the recognition of their mutual concerns.

Where does instructional technology fit into all this? Many educators, when they hear this term, immediately think of slide shows, PSI, videotapes, or computer aided instruction. And indeed, these are some of the tools available to those who solve problems in educational settings. However, they are not the whole picture.

The generally agreed upon definition of IT is, "The application of scientific methods or materials to solution of an educational problem or achievement of an educational goal." Psychological principles and knowledge are one form of scientific "method or material" available to educators. Technological innovations, be they "hardware" or "software," are another. The problem of instructional technology is to translate the rich store of psychological knowledge into usable form for those on the "front lines," and then link that to the tools available--be they expensive videodiscs or inexpensive handouts, game materials, or role play activities--so that learning takes place in the healthiest possible environment for the student. Psychologists can help in the design or selection of appropriate tools by answering questions such as "What makes learning possible? What makes a stimulus meaningful to a learner? What makes a learner want to learn? And how can I make learning easier or more likely to occur?" In this workshop we will explore some ways in which the design of instruction and the selection of technological supports can be based upon psychological understandings of what makes for a "meaningful" learning experience.

"Meaningfulness," to the extent it is operative, can enhance both the willingness to learn ("motivation") and the ability to store and retrieve what is learned ("memory"). In this paper we will examine meaning in the context of two propositions about the nature of motivation and memory (underlined in text). Drawing on psychological concepts, we will explore ways in which instructional technology can be used as a tool in the process of creating meaningful learning experiences for college students.

1.0. External stimuli are only effective motivators when they are meaningful to the learner, i.e., when they form some relationship to internal states.

1.1. One way in which external stimuli become meaningful in this sense is by providing information that either confirms or disconfirms hypotheses the individual is operating under or consciously testing. For young learners, highly specific information presented contingent on the learner's response facilitates most rapid learning. For older learners, such conditions are also helpful but more latitude may be available in the timing or degree of specificity of feedback.

Let's look at an example of this concept in action. Say Mary is struggling to write a paragraph. Her fifth effort comes back with the comment, "You are doing better! Next time, try a little harder." Contrast this with feedback to the effect that,

> "This paragraph is more well organized than any previous example submitted. Your first sentence makes a clear statement of your purpose in writing the paragraph--to convince the reader that recycling cans is a good idea. Each of your next three sentences uses a word that shows where you are in your plan, and you provide good examples. The transition to your conclusion, though, is not smooth; next time try to warn the reader that you are about to wrap it up."

Admittedly the latter response will take more of the teacher's time to prepare. However, if the student is concerned to improve, this type of feedback a) provides the same attention or "strokes" as the other message, and b) additionally clarifies in the learner's mind the desired end behavior.

Instructional technology can facilitate provision of specific, contingent reinforcement in several ways. CAI comes to mind as a fairly pure example. Others include the use of tape recorded feedback messages (the student purchases tape and instructor reads responses to pre-numbered lines of the original). Moore and Anderson's "talking typewriters" were programmed so that the keys would not respond if an incorrect letter was typed. Lecturers can put questions or spot quizzes on slides to be shown at key points, ask students to respond, then have students share their responses and identify the (most) correct one. Texts with answer keys, properly used, can be helpful in implementing this "rule."

1.2 External stimuli also become meaningful to the degree they afford opportunities for fulfillment of predominating social needs. Maslow has described a "hierarchy" of needs, and argues that as "lower level" needs such as safety and security are satisfied, more complex social needs become increasingly important. College students can be expected to, on the whole, have affiliation and esteem needs most active; some may be self-actualizing. By providing "rewards" for learning that consider these needs, professors can help students become more involved in the learning process. Thus, when students have strong security needs, teachers may want to create a sense of trust in the classroom before asking them to participate in open-ended discussions or make formal presentations. Small group or teamwork efforts can allow students to satisfy affiliation needs while learning.

Once satisfied, affiliation needs can be set aside to allow esteem needs to surface. The student may now work in order to do a good job and impress his or her peers. Later, he/she works to satisfy himself, and to experience the satisfaction of mastery over ideas.

Instructional technology may be used to help the instructor identify predominant needs of a class or individual. A teacher-made questionnaire might provide an overview of the group. Listening and observation are also important tools in finding out who your students are. Technological assistance can be useful in identifying and/or creating activities that provide rewards keyed to students' predominant needs. In seeking to stimulate social needs, role play activities are particularly useful but must be selected or designed with sensitivity to the level of social needs demanded by the task.

1.3. Meaningful stimuli also come in the form of problems to be solved. But to key into the internal states of particular individuals, problems must be both manageable and challenging. Presentation of problems in a sequence of increasing difficulty is optimal but practical only where "increasing difficulty" is readily defined (as in math). Instructional technology can help as a tool in identifying, either through research or theoretical analysis, appropriate problem sequences. It is also helpful for identifying student readiness to enter a learning sequence at a specified

point. "Challenging" material may also be conceptualized as material which is unexpected, which, while coming from a reliable, credible source does not fit the students' preconceived ideas. Here the instructional technologist may design a "survey feedback" exercise. In this activity students complete a "test" full of myths or sterotypes about the subject. Their responses are tabulated; totals for each item are shared, their implications discussed, and misconceptions put to rest with factual information.

Problem-solving approaches do require attention to the setting in which problems are presented. Psychological phenomena are more evident in a problem-solving classroom than in the traditional mode. Use of familiar materials makes most tasks less awesome to students. If this is not possible, use of visual or audiovisual technology can help make the problem to be solved more "real" and understandable to students. It is also possible in some cases to remind students of their own past experiences for purposes of comparison to or contrast with the context or issue of the problem at hand. For instance, if a student fails to understand the notion of criteria for significance in the reconstruction of history, one might help the student become aware of criteria he/she uses to select or identify "significant" events in his/her own "history."[1]

Furthermore, a stance of play or exploration is beneficial in preventing frustration possible where students are unaccustomed to having to construct their own "answers."

[1]Acknowledgements to Richard Thomas, Illinois Central College, for this example.

"Playfulness" is facilitated by work in small groups. A healthy competitive approach may be stimulated by having groups try to come up with the "best" (not necessarily the fastest) solution and offering humorous prizes to winners. Brainstorming is a specific technique useful in stimulating an open-minded search for possibilities. Technological assistance in devising games or simulations may be necessary for faculty unaccustomed to teaching in this way. It may also be helpful to monitor one's style as new approaches are tried. Videotaping of sessions, or simply having a student or colleague make observations, provide rich sources of data on how healthy a problem-solving environment you have been able to create. Things to watch for include collaborative efforts among students, students questioning each other more than the teacher, teacher responding to questions with questions as opposed to answers, teacher "wait time" after asking a question (less than 10 seconds and your students' slower thought processes don't have a chance!), and encouragement rather than "put downs" when students make mistakes. Teacher responses to students' incorrect attempts should zero in on the logic of the students' concepts, making that logic explicit to the student, helping the student identify assumptions being made, and guiding the student to see alternative approaches. In all these ways we give students' internal states (of both knowledge and affect) a chance to connect with the external stimuli presented by the problem and its context.

2.0. The more organizing and the higher the level of organizational activity done by the student, the greater the probability that he/she will be able to retain and use the information acquired.

In illustrating this concept, we will deal with four levels of organizational activity ("information processing") from the simplest and most passive to the most active and complex.

2.1. The probability of recall of information is directly proportional to the number of opportunities to strengthen the associations between related stimuli. Freely translated this means that the more often the student links two terms, concepts, processes, etc. together in time and space the better he or she will remember them. Drills are a common example of this rule; they are a fairly elementary application and do not make for the most enjoyable learning. Using more thoughtful instructional design we find it possible to construct simple games (e.g. a bingo game where the answer is on the card but the question is what is called out) that reinforce associations and at the same time create a positive atmosphere. Mnemonic devices, either supplied by the teacher or (better yet) the student under teacher guidance, are a widely known and highly effective means of strengthening associations. Clearly, these methods are best used for learning of bare bones essentials, definitions, formulas, and other foundational items that simply have to be mentioned.

2.2 Recall is facilitated when students are provided with or encouraged to create, some means of separating "figure" from "ground" (or "wheat" from "chaff," depending on your point of view) in the wealth of stimuli they experience. Not every word you say, nor every word they read, is important. How are they to know what to focus on? They need your help. You probably already do lots of things in this department, perhaps never realizing you were making use of teaching technology. You give students lecture outlines. You write key phrases or concepts on the board or the overhead. You summarize yesterday's presentation before going on; and you summarize today's both at the beginning and the end of class. You present your objectives in the course outline or for each unit. You encourage students to use the SQ3R (Survey, Question, Read, Write, Recite or Review) method of studying, and you give them study. questions to help them through the "Q" part. Use of "pop" quizzes (no credit) is another very vivid means of highlighting what you want them to get from the material. Helping them identify criteria of importance is a more sophisticated approach to the figure/ground problem.

2.3 Reorganization or restructuring of material allows the student to integrate it in an active way and facilitate later recall. The ultimate restructuring (according to some schools) is the great "A-HA" experience at the moment of achieving a solution to a challenging problem. We considered problem-solving in depth under 1.3. Here we

might just note that in the present context, a "good" problem might be one that asks the students to find a simple way to present a long string of factual information. The information should be such that it can be reworked into a structure such as a matrix. In discovering the matrix, the students will provide themselves with a valuable tool for recall as well as going over the material extensively, thus strengthing their associations with respect to it. Once students have "discovered" the matrix approach they may spontaneously try to use it on other problems. Encourage this by offering material that lends itself to such a structure.

Other reorganizing mechanisms include creation of hierarchical or "nested" categories, serial ordering (e.g. from smallest to largest, or least to most dense) and chronological ordering. The latter suggests some games that might work well in a history class. Students might be given a set of events (real or even imaginary) related to what they are learning, and asked to work in small groups at putting them in proper order. This has also been done with passages from Shakespeare! An important part of the process is the debate among peers, the questioning and challenging of each others' constructs. The professor unused to this type of activity should not be dismayed if the noise level climbs. (Remember that some of your own most exciting intellectual experiences occurred in debates written, oral, or mental with colleagues!)

2.4 When both hemispheres of the brain are actively engaged in the learning process, recall is more likely to occur. Although research on this topic is relatively recent, evidence is accumulating that learning is best when both the left (analytic, verbal) and right (holistic, spatial) hemispheres are combining forces. Most teaching, notably lecture and reading, addresses the left brain. Use of nonverbal modes of interaction with material will redress this balance.

The exercises in 2.3 integrate visual (the matrix) and verbal (the information) processes. Instructional technology designed to let students work with tangible objects to arrive at principles or concepts taps right-hemispheric processes as well. In DOORS English, students discover the relationship between a thesis statement and topic sentences by classifying small blocks hierarchically.[2] Many realize for the first time what 12 years of purely verbal English teaching could not communicate.

Conclusion

By now perhaps two key points should be clear, 1) There is no magic to instructional technology, but it encompasses much that you may already be doing; and 2) In general, the more active the learner is in the discovery of concepts or organizing structures, the more (s)he will truly learn and the more he or she will enjoy the learning process.

[2]Acknowledgements for this example go the Karl Taylor, ICC.